Check List of the Worm Parasites of Domesticated Animals in South Africa.

By H. O. MONNIG, B.A., Ph.D., B.V.Sc., Research Officer, Onderstepoort.

Digitised by the University of Pretoria, Library Services

Check List of the Worm Parasites of Domesticated Animals in South Africa.

By H. O. Monnig, B.A., Ph.D., B.V.Sc., Research Officer, Onderstepoort.

The following is intended to serve as a check-list of the worm parasites so far collected from the domestic animals in South Africa, and also to aid veterinarians in the field in the identification of these worms. The descriptions given must necessarily be short, but such characteristics were selected which had been found in practice to be the most typical of each worm and sufficient for preliminary recognition; wherever possible such points were given by which the worms could be recognized at post-mortem with the naked eye.

The chief source of this material is from the post-mortem table at Onderstepoort Laboratory, since practically no survey work has been done in other parts of the country, although the animals examined here come from various parts. This is also the reason why parasites of the cat and of poultry, except the fowl, have so far not been collected to any great extent. Veterinarians in the field could greatly assist to build up a representative collection of South African parasitic worms by collecting and forwarding to the Laboratory material of all worms not mentioned in this list. Moreover would such assistance also be greatly appreciated where worms from wild animals are concerned, since facilities for collecting these are very scanty at the Laboratory itself.

The common names of the following animals are used without further reference to their zoological names:—Horse (*Equus caballus*), mule (*Equus caballus* × *E. asinus*), donkey (*Equus asinus*), sheep (*Ovis aries*), goat (*Capra hircus*), cattle (*Bos taurus*), pig (*Sus scrofa domestica*), dog (*Canis familiaris*), cat (*Felis domestica*), fowl (*Gallus gallus*), turkey (*Meleagris gallopavo domesticus*); in other cases the zoological names are added. The names of the birds are given according to the list of Roberts (1924), while the names of mammals are given according to an as yet unpublished list by the same author.

The system of classification of the nematodes adopted in this paper is that given by Yorke and Maplestone in their recent work on "The Nematode Parasites of Vertebrates." These authors have effected considerable changes in nematode classification, especially in the super-family *Strongyloidea*, where the system of Raillet and others, based on sexual characters, is replaced by a system based on cephalic characters. Whether this produces a more natural classification is a question on which the present writer would not like to express an opinion without further study, although *a priori* it is evident to every zoologist that the most natural classification is usually based on sexual characters. This classification is therefore followed here because this check-list may be used together with the book of Yorke and Maplestone, which contains keys for the identification of all the genera.

Digitised by the University of Pretoria, Library Services

TREMATODA.

Amphistomata Bojanus, 1817.

Fam. *Paramphistomidae* Fischoed., 1901.
Subfam. *Paramphistominae* Fischoed., 1901.
Genus *Paramphistomum* Fischoed., 1901 (Syn. *Amphistoma* Rud., 1801).

This genus has not yet been properly studied in South Africa, and as there is still some confusion in the literature it was thought best to make a good collection before proceeding to study the specimens. The following species have, however, been frequently found and determined, and are thus listed here:—

P. calicophorum Fischoed., 1901.—Rumen and reticulum of cattle and sheep.

P. microbothrium Fischoed., 1901.—Rumen and reticulum of cattle and sheep.

Paramphistomum sp., immature.—Found on several occasions in immense numbers in the small intestines of cattle and sheep; the animals usually showed marked diarrhoea and emaciation, and deaths occurred.

Fam. *Gastrodisciidae* Stiles and Goldb., 1910.
Genus *Gastrodiscus* Leuck., 1877.

G. aegyptiacus (Cobbold, 1876).—Found in the colon and caecum of the horse; infrequent. The worm measures about 1 cm. in diameter, is saucer-shaped, and pink in colour.

Distomata Zed., 1800.

Fam. *Fasciolidae* Rail., 1895.
Subfam. *Fasciolinae* Stiles and Hass., 1898.
Genus *Fasciola* L., 1758.

F. hepatica L., 1758.—Frequent in the bile ducts of cattle and sheep.

F. gigantica Cobbold, 1855.—Differs from the foregoing species in being longer and narrower. Situation and frequency the same.

Fam. *Troglotremidae* Odhner, 1914.
Genus *Paragonimus* Braun, 1899.

P. westermannii (Kerbert, 1878).—Found once in the lungs of a cat in Zululand. Some authors distinguish between different species from different hosts, and so, according to Ward and Hirsch (1915), and Vevers, this specimen from the cat is *P. kellicotti*. These worms are more or less bean-shaped and occur in pairs in cysts in the lungs of various carnivores, the pig, and man.

Fam. *Schistosmidae* Looss, 1899.
Genus *Schistosoma* Weinl., 1858. (Syn. *Bilharzia* Cobbold, 1859.)

S. bovis (Sons., 1876), found in the heart and bloodvessels of cattle, especially in Natal, but not very frequent.

Also found in mesenteric veins of sheep and is being studied.

Digitised by the University of Pretoria, Library Services

Cestoda.

Cyclophyllidea Ben.

Fam. *Anoplocephalidae* Kholodk., 1902.
Subfam. *Anoplocephalinae* R. Blanch., 1891.
Genus *Anoplocephala* E. Bl., 1848.

A. magna (Abild., 1789). (Syn. *A. plicata* Zed., 1800.)—Infrequent in small intestine of the horse, donkey, and zebra (*Hippotigris burchelli wahlbergi*); also found in the white rhinoceros (*Ceratotherium simum*).

A. perfoliata (Goeze, 1782).—More frequent than the previous species; occurs in the small intestine and caecum of the horse, donkey, and zebra. These two species can be distinguished by the presence of small lappets behind the suckers of *A. perfoliata*, absent in the other (Figs. 1 and 2); besides, the head of *A. magna* is much larger, measuring 4-6 mm. in diameter, and the segmentation of the body is coarser.

A. mamillana (Mehlis, 1831).—Recorded by Veglia (1919) from a horse. This species is small, 1–3 cm. long and 4–6 mm. broad.

Genus *Moniezia* R. Bl., 1891.

M. alba (Perr., 1879).—Found rarely in the small intestine of cattle.

M. expansa (Rud., 1810).—Frequent in the small intestine of sheep, especially lambs; also found in cattle, and by Gough (1908) in the blue duiker (*Cephalophus monticola*).

M. trigonophora St. and Hass., 1892.—Small intestine of sheep, goat, cattle; and by Baer (1925) in the duiker (*Sylvicapra grimmi transvaalensis*), the steenbok (*Pediotragus horstocki-campestris*), and Sharp's steenbok (*Pediotragus Sharpei*). This species is next in frequency to *M. expansa*.

M. planissima St. and Hass., 1892.—Found only once in a camel (*Camelus dromedarius*). The moniezias are broad tapeworms with two sets of reproductive organs in each segment, which can be seen in fresh specimens (Fig. 9). In *M. planissima* (Fig. 3) the interproglottidal glands are linear; in *M. alba* they are absent; in the other two specimens they are grouped around blind sacs. These can only be seen in prepared specimens. In *M. expansa* (Fig. 4) the testes are scattered through the whole segment; in *M. trigonophora* (Fig. 5) they lie in two triangular groups, one on each side.

M. pallida. Monnig, 1926.—Small intestine of horse; rare.

The worm has the general outward appearance of a *Moniezia*, measuring 138 cm. in length. The segments are all much broader than long and slightly overlapping; the mature segments are 0·75 mm. long and 11 mm. broad, the ripe segments are 1·5 mm. long and 21 mm. broad. The head is unarmed, but there are four well-developed suckers facing anteriorily; the head, as seen from the front, is not square but dorsoventrally compressed, measuring 0·75 mm. in breadth. There is a well developed neck (Fig. 6).

The interproglottidal glands are linear, i.e. of the *Planissima* type, but they are very indistinct in all stained specimens and sections; they are 1·1 mm. broad in mature segments and 2 mm. in ripe segments.

Digitised by the University of Pretoria, Library Services

The cuticle is 8 μ thick; under it is a layer of subcuticular cells 19 μ wide. The longitudinal muscles are more or less diffuse, lying chiefly against the transverse layer. The latter, as well as the dorso-ventral muscles are well developed.

The excretory system consists of the usual four longitudinal vessels and transverse branches. The dorsal vessel lies median to the ventral.

The genital pores are double and there are two complete sets of reproductive organs in each proglottis. The genital pores open somewhat anterior to the middle of the proglottis. The genital ducts pass dorsally to the excretory vessels and the nerve; the vagina is ventral to the cirrus on the right side and dorsal to it on the left. The testes occupy the whole of the median field, and there are also a few on the poral side of the ovary. The vas deferens makes several coils before entering the cirrus pouch and is distended with spermatozoa. The cirrus pouch reaches up to the ventral excretory duct and measures 0·23 mm. by 0·08 mm.; the cirrus is 0·13 mm. long by 0·04 mm. and is inerm. The vagina is slightly coiled and ends in a large receptaculum seminis. The ovary is fan-shaped, broader than long, finely lobed, measuring 1·06 mm. in breadth by 0·48 mm. in length. The yolk gland is well developed and is situated dorsally to the ovary. The oviduct joins the ovary directly in front of the yolk gland (Fig. 7). The uterus is at first a reticulum of slender branches and occupies the whole of the median field, also extending across the lateral excretory ducts. When it is filled with eggs it occupies practically the whole of the medulla, its branches passing chiefly dorsally, but also quite frequently ventrally to the longitudinal excretory ducts (Fig. 8). In this point *M. pallida* differs from all other Moniezias, in which, according to Douthitt (1915), the uterus passes dorsally across the longitudinal excretory ducts or not at all. However, this difference, even coupled with the fact that the mammalian moniezias are typically parasites of ruminants, does not seem to me to justify the creation of a new genus.

Subfam. *Thysanosominae* Fuhrm., 1907.
Genus *Thysanosoma* Dies., 1835.

T. giardi (Moniez, 1879).—Fairly frequent in small intestine of cattle, sheep, and goat; also found in the hartebeest (*Bubalis caama*) and by Gough (1908) in the eland (*Taurotragus oryx*). This is a broad tapeworm with single and irregularly alternating genital organs (Fig. 9); in the male portion the penes can usually be seen protruding at the sides and giving a characteristic appearance to the fresh specimen.

Subfam. *Avitellininae* Gough, 1911.
Genus *Avitellina* Gough, 1911.

A. centripunctata (Riv., 1874).—Fairly frequent in small intestine of sheep; also recorded by Baer (1925) from the duiker (*Sylvicapra grimmi transvaalensis*), the common steenbok (*Pediotragus horstocki*), Sharp's steenbok (*P. sharpei*), the klipspringer (*Oreotragus oreotragus*), and the roan antelope (*Hippotragus equinus*). This is a narrow tapeworm, usually not over 3·5 mm. broad, with the uterus in ripe segments showing as an opaque line running down the middle line; the segmentation is very fine (Fig. 10).

Digitised by the University of Pretoria, Library Services

Genus *Stilesia* Rail., 1893.

S. hepatica Wolffh., 1903.—A very narrow and delicate tapeworm, common in the bile ducts of sheep and goats, also found in cattle and recorded by Wolffhügel (1903) from the duiker (*Sylvicapra grimmi transvaalensis*) and the roan antelope (*Hippotragus equinus*). It produces a thickening of the bile-ducts like the liver-fluke, but has apparently no other harmful effects.

Fam. *Davaineidae* Fuhrm., 1907.
Subfam. *Davaineinae* Braun, 1900.
Genus *Davainea* R. Bl. and Rail., 1891.

D. proglottina (Dav., 1860).—Small intestine of fowl. This worm is very small, consisting of only two to five segments, and can usually be found only by examining scrapings of the intestinal mucosa.

Genus *Raillietina* Fuhrm., 1920.
Subgen. *Raillietina* Fuhrm., 1924.

R. (*Raillietina*) *crassula* (Rud., 1819).—Small intestine of domestic pigeon, according to Le Roux (1926).

Subgen. *Ransomia* Fuhrm., 1920

R. (*Ransomia*) *tetragona* (Mol., 1858).—Small intestine of fowl. This is the commonest fowl tapeworm in South Africa (Fig. 11C).

R. (*Ransomia*) *echinobothrida* (Megn., 1880) (Fig. 11D).—Fairly frequent in small intestine of fowl. The young worms form nodules in the wall of the anterior part of the small intestine, from which their bodies can usually be seen to protrude into the lumen. The above two species are difficult to distinguish from each other; they have seven to eight rows of small hooks on the suckers, but these are much stronger in *R. echinobothrida* than in *R. tetragona*.

The rostellum of the former bears about 100 hooks, that of the latter about 200. They both have long thin necks.

Subgen. *Skriabinia* Fuhrm., 1920.

R. (*Skriabinia*) *cesticillus* (Mol., 1858).—Moderately frequent in small intestine of fowl. It is usually short and has no thin neck; in the posterior part the borders of the proglottides overlap (Fig. 11E). (See *Choanotaenia infundibuliformis*.)

Genus Houttuynia Fuhrm., 1920.

H. struthionis (*Houttuyn*).—Small intestine of ostrich (*Struthio australis*). Tapeworms are not uncommon in ostriches in South Africa, and there may possibly be more than one species.

Fam. *Dilepinidae* Fuhrm., 1907.
Subfam. *Dilepininae* Fuhrm., 1907.
Genus *Amoebotaenia* Cohn., 1899.

A. sphenoides (Rail., 1892).—Small intestine of fowl; moderately frequent. This is a small tapeworm, consisting of twelve to eighteen segments; it is 2–3·5 mm. long and relatively broad (Fig. 12).

Subfam. *Dipylidiinae* Stiles, 1896.
Genus *Dipylidium* Leuck., 1863.

D. sexcoronatum Ratz, 1900.—Frequent in the dog and cat; small intestine.

Digitised by the University of Pretoria, Library Services

D. canium (L., 1758).—Small intestine of dog. Recorded by Gough (1908) from the black-backed jackal (*Thos mesomelas*) and by Baer (1925) from the long-eared fox (*Otocyon megalotis*) and the aard-wolf (*Proteles cristatus*). This species is relatively rare. I have found it in only one out of about eighty dogs with *Dipylidium*, the others were all *D. sexcoronatum*. *D. caninum* has three to four rows of hooks on the rostellum, 100–200 testes, the cirrus-pouch reaches up to or passes the longitudinal excretory duct and the ripe proglottides measure up to 11 by 3 mm. *D. sexcoronatum* has six (or five) rows of hooks, 130-140 testes; the cirrus-pouch does not pass the excretory canal and the ripe proglottides are never quite as large as in the other species.

Genus *Choanotaenia* Rail., 1896.

C. infundibuliformis (Goeze, 1782).—Small intestine of fowl; not frequent (Fig. 11B). This species can easily be confused with *R. cesticillus* from its external appearance. The rostellum bears a single row of sixteen to twenty hooks 25–30 μ long, while on the rostellum of *R. cesticillus* there are about 400–500 hooks 7–12 μ long, in two rows.

Fam. *Hymenolepinidae* Fuhrm., 1907.
Genus *Hymenolepis* Weinl., 1858.

H. carioca (Magalh., 1898).—Small intestine of fowl; moderately frequent.

H. inermis Yoshida, 1910.—Small intestine of fowl; infrequent; recorded by Le Roux (1926).

Hymenolepis sp. Le Roux, 1926.—Small intestine of fowl, recorded by Le Roux from fowls in Natal. The Hymenolepids are small, filiform; the rostellum is either armed or unarmed; genital pores unilateral, three testes in each proglottis.

Fam. *Taeniidae* Ludw., 1886.
Genus *Taenia* L., 1758.

T. solum L., 1758.—The adult tapeworm is relatively frequent in South Africa, especially amongst natives. The larval stage, *Cysticercus cellulosae*, is found frequently in the pig.

T. saginata (Goeze, 1782).—The adult tapeworm is relatively frequent in South Africa, especially amongst natives. The larval stage, *Cysticercus bovis*, is found fairly frequently in cattle.

T. hydatigena Pallas, 1776. (Syn. *T. marginata Batsch* 1786).—Small intestine of dog; fairly frequent. The larval stage, *Cysticercus tenuicollis*, is frequent in the sheep and goat; also found in the pig, the gemsbok (*Oryx gazella*), the springbok (*Antidorcas masupialis*), and by Gough (1908) in the duiker (*Sylvicapra grimmi transvaalensis*) and the rooi rhebok (*Redunca fulvorufula*).

T. multiceps Leske, 1780. (Syn. *T. coenurus*, *Multiceps multiceps*.)—Moderately frequent in the small intestine of the dog and the black-backed jackal (*Thos mesomelas*). This species can be distinguished from *T. hydatigena* by the presence of an S-shaped loop formed by the vagina lateral to the excretory canal. The larval stage, *Multiceps multiceps* (Syn. *Coenurus cerebralis*) has been found in the brains of sheep, calves and goats; fairly frequent in certain areas.

Digitised by the University of Pretoria, Library Services

Multiceps gaigeri.—Found once in the intermuscular tissue of the thigh of a goat and recorded (Monnig, 1926A) as *Multiceps multiceps*. This is the larval form of *Taenia gaigeri* of the dog, which has not yet been found in South Africa.

T. serrata Goeze, 1782.—Small intestine of dog; rare.

T. taeniaeformis Rud., 1810.—Small intestine of cat. The *Cysticercus fasciolaris* has been found in the livers of rats (*Rattus rattus*).

T. ovis (Cobbold, 1869).—Mentioned by Baer (1925) from *Canis familiaris*, South Africa.

Genus *Echinococcus* Rud., 1801.

E. granulosus Batsch, 1786 (Syn. *Taenia echinococcus*).—Found in small intestine of the dog, the cat (Veglia, 1919), the wild dog (*Lycaon pictus venaticus*.), and the silver fox (*Vulpes chama*). The latter two cases were obtained from the Zoological Gardens at Pretoria and Johannesburg, and probably are artificial infections through food. However, this parasite does not appear to be frequent in dogs, and since echinococcus cysts occur in 5–10 per cent. of slaughtered cattle and sheep, also in goats and pigs, it is very probable that wild carnivora play a great part in the infection of these animals. Cameron (1926) recently described what he considers to be possibly a new species, *Echinococcus longimanubrius*, from *Lycaon capensis* (South Africa), in which, amongst other characteristics, the small hook has a long handle. My material from *Lycaon* does not correspond with this description.

NEMATODA.

Superfam. *Rhabdiasoidea* Rail., 1916.
Fam. *Rhabdiasidae* Rail., 1915.
Genus *Strongyloides* Grassi, 1879.

S. papillosus (Wedl., 1856).—Frequent in small intestine of sheep and goat in the form of a hermaphrodite generation. These worms are small, measuring about 4 mm. in length, and can be distinguished from the intestinal Trichostrongyles by their smaller size, the *Trichostrongylus* females measuring 5·8–7·5 mm., and by the position of the vulva, which is nearer to the middle than in *Trichostrongylus*.

Generally the eggs of these females develop into larvae, which are infective after two ecdysis, but under certain unknown conditions it is sometimes seen that the eggs give rise to a free-living generation of males and females, the eggs of the latter again developing into infective larvae.

Superfam. *Trichocephaloidea* nov. nom.
Fam. *Trichocephalidae* Baird, 1853.
Subfam. *Trichocephalinae* nov. nom.
Genus *Trichocephalus* Schrank, 1788.

T. ovis (Abildg, 1795).—Frequent in the large intestine of sheep, goat, and cattle. The " whipworm " is characterized by its long, thin neck and shorter, thick body.

T. suis (Schrank, 1788).—Fairly frequent in large intestine of the pig.

Digitised by the University of Pretoria, Library Services

Subfam. *Capillariinae* Rail., 1915.
Genus *Capillaria* Zed., 1800.

C. retusa (Rail., 1893).—Small intestine of fowl; recorded by Le Roux (1926).

C. strumosa (Reibisch., 1893).—Crop of fowl; recorded by Le Roux (1926).

C. columbae (Rud., 1819).—Small intestine of pigeon; recorded by Le Roux (1926). The Capillarias are very thin worms, the posterior part of the body being slightly thicker than the anterior; the oesophagus is long; there are " bacillary bands " on the cuticula and the male has one well-developed spicule.

Superfam. *Strongyloidea* Weinl., 1858.
Fam. *Strongylidae* Baird 1853.
Subfam. *Strongylinae* Rail., 1893.
Genus *Strongylus* Goeze. 1782.
Subgenus *Strongylus* Rail., 1923.

S. (*Strongylus*) *equinus* (Müll., 1780).—Frequent in horse, mule, and donkey.(1)

Subgenus *Alfortia* Rail., 1923.

S. (*Alfortia*) *edentatus* (Looss, 1900).—More frequent than previous species in horse, mule, and donkey.

Subgenus *Delafondia* Rail., 1923.

S. (*Delafondia*) *vulgaris* (Looss, 1900).—Most frequent of the three species in horse, mule, donkey, zebra, and mountain zebra (*Hippotigris zebra*).

S. (*Delafondia*) *asini* (Boulenger, 1920).—Found in the colon of the mountain zebra.

Genus *Oesophagodontus* Rail. and Henry, 1902.

O. robustus (Giles, 1892).—Horse, mule.

Genus *Triodontophorus* Looss, 1900.

T. serratus Looss, 1900.—Horse, mule, donkey, mountain zebra.

T. brevicauda Blgr., 1916.—Horse, donkey.

T. tenuicollis Blgr., 1916.—Horse, mule, donkey, mountain zebra.

T. minor Looss, 1900.—Horse, mule, donkey, mountain zebra.

Genus Craterostomum Blgr., 1920.

C. mucronatum (Ihle, 1920).—Horse, mule, donkey, zebra, mountain zebra.

Genus *Codiostomum* Rail. and Henry, 1911.

C. struthionis (Horst, 1885).—Moderately frequent in colon of ostrich. The mouth capsule is well developed and resembles that of the genus *Strongylus*; the male bursa is relatively large and stands out in a dorsal direction (Fig. 13).

(1) For specific characters, location, frequency, etc., of the Nematodes of Equines see G. Theiler: "The Strongylids and other Nematodes parasitic in the Intestinal Tract of S.A. Equines," 9th and 10th Reports of the D.V.E. and R., 1923; 120 pp., 55 pls.

Digitised by the University of Pretoria, Library Services

Subfam. *Stephanurinae* Rail., Henry, and Bauche, 1919.
Genus *Stephanurus* Dies., 1839

S. dentatus Dies., 1839.—Rare; in the perirenal fat of the pig; stout worms, 2–5 cm. long

Subfam. *Trichoneminae* Rail., 1916 (Syn. *Cylicostominae*, Rail., 1915).
Genus *Trichonemina* Cobbold, 1874 (Syn. *Cylicostomum* Rail., 1901).
Subgenus *Trichonema* (Cobbold, 1874) Le Roux, 1924. (Syn. *Cylicostephanus* Ihle, 1922.)

T. (*Trichonema*) *longibursatum* (Yorke and Macfie, 1918).—Horse, mule, donkey, mountain zebra.

T. (*Trichonema*) *calicatum* (Looss, 1900.—Horse, mule, donkey, mountain zebra.

T. (*Trichonema*) *minutum* (Yorke and Macfie, 1918).—Horse, mule, donkey, mountain zebra.

T. (*Trichonema*) *poculatum* (Looss, 1900).—Horse.

Subgenus *Cylicostomum* Ihle, 1922.

T. (*Cylicostomum*) *aegyptiacum* Rail., 1923.—Donkey, zebra, mountain zebra.

T. (*Cylicostomum*) *labratum* (Looss, 1900).—Horse, mule, donkey.

T. (*Cylicostomum*) *labiatum* (Looss, 1902).—Horse, mule, donkey.

T. (*Cylicostomum*) *labiatum* var. *digitatum* (Ihle, 1921).—Horse, mule, donkey.

T. (*Cylicostomum*) *coronatum* (Looss, 1900).—Horse, mule, donkey, zebra.

Subgenus *Cylicocercus* Ihle, 1922.

T. (*Cylicocercus*) *alveatum* (Looss, 1900).—Horse, zebra.

T. (*Cylicocercus*) *catinatum* (Looss, 1900).—Horse, mule donkey,

T. (*Cylicocercus*) *catinatum*, var *pseudocatinatum* (Yorke and Macfie, 1919).—Horse, mule, and donkey.

T. (*Cylicocercus*) *pateratum* (Yorke and Macfie, 1919).—Horse, mule, and donkey.

T. (*Cylicocercus*) *goldi* (Blgr., 1917).—Horse, mule, donkey.

Subgenus *Cylicocyclus* Ihle, 1922.

T. (*Cylicocyclus*) *insigne* (Blgr., 1917).—Horse, mule, donkey, zebra, and mountain zebra.

T. (*Cylicocyclus*) *triramosum* (Yorke and Macfie, 1920).—Donkey, zebra, mountain zebra.

T. (*Cylicocyclus*) *radiatum* (Looss, 1900).—Horse, mule, donkey.

T. (*Cylicocyclus*) *elongatum* (Looss, 1900).—Horse and donkey.

T. (*Cylicocyclus*) *elongatum*, var. *Kotláni* (Ihle, 1920).—Horse and donkey.

T. (*Cylicocylus*) *adersi* (Blgr., 1920).—Donkey, mule, zebra.

T. (*Cylicocyclus*) *auriculatum* (Looss, 1900).—Donkey, mountain zebra.

Digitised by the University of Pretoria, Library Services

T. (*Cylicocyclus*) *nassatum* (Looss, 1900).—Horse, mule, donkey.

T. (*Cylicocyclus*) *nassatum*, var. *parvum* (Yorke and Macfie, 1918).—Horse, mule, donkey.

T. (*Cylicocyclus*) *leptostomum* (Kotlán, 1920).—Horse, mule, donkey.

Subgenus *Cylicodontophorus* Ihle, 1922.

T. (*Cylicodontophorus*) *bicoronatum* (Looss, 1900).—Horse, mule, donkey.

T. (*Cylicodontophorus*) *euproctum* (Blgr., 1917).—Horse, mule, donkey.

T. (*Cylicodontophorus*) *mettami* (Leiper, 1913).—Horse, mule, donkey.

T. (*Cylicodontophorus*) *ultrajectinum* (Ihle, 1920).—Horse, mule,

Subgenus *Cylicotetrapedon* Ihle, 1925.

T. (*Cylicotetrapedon*) *asymetricum* (G. Theiler, 1923).—Horse, mule, donkey.

Subgenus *Cylicobrachitus* (Cram, 1924).

T. (*Cylicobrachitus*) *brevicapsulatum* (Ihle, 1920).—Horse.

Subgenus *Cylicotoichus* (Cram, 1924).

T. (*Cylicotoichus*) *montgomeryi* (Blgr., 1920).—Horse, mule.

Genus *Poteriostomum* Quiel, 1919.

P. imparidentatum Quiel, 1919.—Horse, mule, donkey, zebra.

P. Ratzii Kotlán, 1919.—Horse, mule, donkey, zebra.

P. Ratzii, var. *nanum*, G. Theiler, 1923.—Horse.

Genus *Gyalocephalus* Looss, 1900.

G. capitatus Looss, 1900.—Horse, mule, donkey.

Genus *Cylindropharynx* Leiper, 1911.

G. intermedia G. Theiler, 1923.—Zebra, mountain zebra.

C. ornata Cram, 1924.—Zebra.

Subfam. *Oesophagostominae* Rail., 1915.

Genus *Oesophagostomum* Mol., 1861.

O. columbianum Curtice, 1890.—Very frequent in caecum and colon of sheep and goat; also found in the reedbuck (*Redunca arundinum*) and the bushbuck (*Tragelaphus sylvaticus*).

O. radiatum (Rud., 1803).—Fairly frequent in caecum and colon of cattle.

O. dentatum (Rud., 1803).—Fairly frequent in caecum and colon of pig.

The Oesophagostomes are characterized by a small buccal cavity which contains one or two crowns of delicate leaf-like processes; the cuticle around the mouth is inflated to form a mouth collar; the male bursa is well developed (Figs. 14 and 15); the vulva is situated near the tail of the female, and is closed after fertilization by a small mass of a dark brown substance which is usually visible with the naked eye.

Genus *Chabertia* Rail and Henry, 1909.

C. ovina (Fabr., 1788).—Recorded by Veglia (1919) from the

Digitised by the University of Pretoria, Library Services

large intestine of a sheep. This species has a buccal cavity which somewhat resembles that of *Bunostomum*, but opens antero-ventrally, has no teeth, and is surrounded at its orifice by a double crown of numerous small triangular pointed processes.

Fam. *Ancylostomidae* (Looss, 1905) Lane, 1917.
Subfam. *Ancylostominae* (Looss, 1915) Stephens, 1916.
Genus *Ancylostoma* Dub., 1843.

A. caninum (Erc. 1859).—Frequent in small intestine of dog; also found in the cat and the small-spotted genet (*Genetta ludia*).

A. braziliense De Faria, 1910 (Syn. *A. ceylanicum* Looss, 1911).—Accompanies the previous species in the small intestine of the dog. The Ancylostomes (hookworms) are characterised by the presence of a large buccal cavity which opens on the dorsal side and contains teeth. *A. caninum* has a large three-pronged tooth on each side (Fig. 16), while *A. braziliense* has one large simple tooth partly covering another small one on each side (Fig. 17).

Subfam. *Necatorinae* Lane, 1917.
Genus *Bunostomum* Rail., 1902.

B. phlebotomum (Rail., 1900).—Moderately frequent in small intestine of cattle.

B. trigonocephalum (Rud., 1808).—Fairly frequent in certain districts in jejunum and ileum of sheep and goats; also found in the reedbuck (*Redunca arundinum*). These parasites, also called "hookworms," have a buccal cavity opening dorsally and containing three teeth at its base, a large one dorsally and two small ones ventrally (Fig. 18). The dorsal lobe of the male bursa is smaller than the lateral lobes and asymmetrically placed. The spicules of the male are 3·5–4 mm. long in *B. phlebotomum* and 600–640 μ in *B. trigonocephalum*.

Genus *Gaigeria* Rail. and Henry, 1910.

G. pachyscelis Rail. and Henry, 1910.—Fairly frequent in certain districts in duodenum of sheep. This species looks very much like *Bunostomum*, but the dorsal lobe of the male bursa is much larger than the lateral lobes and the tail of the female is shorter and thicker; the worm itself is also larger than *B. trigonocephalum*.

Fam. *Trichostrongylidae* Leiper, 1912.
Subfam. *Trichostrongylinae* Leiper, 1908.
Genus *Trichostrongylus* Looss, 1905.

T. instabilis (Rail., 1893).—Frequent in small intestine and sometimes abomasum of sheep, goats, and cattle.

T. axei (Cobbold, 1879) (Syn. *T. extenuatus* Rail., 1898).—Moderately frequent in abomasum of sheep and goats; rare in stomach of the horse.

T. rugatus Monnig, 1924.—Frequent in small intestine of sheep and goat.

T. tenuis (Mehl., 1846).—Found in small intestine of fowl by Le Roux (1926) in Natal. The first three species of Trichostrongyles from sheep can be most easily distinguished by the appearance of the male spicules (Figs. 19, 20, and 21)

Digitised by the University of Pretoria, Library Services

Genus *Cooperia* Rans., 1907.

C. pectinata Rans., 1907.—Fairly frequent in abomasum and small intestine of cattle. Practically every bovine post-mortemed at Onderstepoort harbours at least a few specimens.

C. punctata (Schnyder, 1907).—Often accompanies the previous species. The Cooperias are small worms, 5-12 mm. long, characterized by 14–16 longitudinal ridges on the surface of the body, which under a high magnification appear to be made up of small punctations. The two species recorded above can be differentiated by the appearance of the male spicules (Figs. 22 and 23), and by the fact that the female of the first species bears a linguiform process over the vulva.

C. oncophora (Rail., 1898).—Recorded by Veglia (1919) from a sheep.

Genus *Haemonchus* Cobb., 1898.

H. contortus (Rud., 1803).—Very frequent in abomasum of sheep, goats and cattle. The female shows the typical " barber's pole " appearance of the white ovaries wound round the dark red intestine, and has a large linguiform process overhanging the vulva. This process is often reduced to a knob in specimens from cattle. The male bursa has long lateral lobes and a small asymetrically placed dorsal lobe (Fig. 24).

Genus *Nematodirus* Rans., 1907.

N. spathiger (Raill., 1896).—Moderately frequent in small intestine of sheep and goat. This worm is 10-20 mm. long, the neck is thin, and usually coiled up when the worm is found in the intestine; the dorsal lobe of the male bursa is split into two parts, each supported by a dorsal ray which originates independently of the other (Fig. 25).

Genus *Ostertagia* Rans., 1907.

O. circumcincta (Stadelman, 1894).—Moderately frequent in abomasum of sheep and goat.

O. ostertagi (Stiles, 1892).—Moderately frequent in abomasum of sheep and goat. These " brown stomach-worms " are smaller than *Haemonchus*, measuring 6·5–12 mm., and are of a dark brown colour. The cuticle shows 25–35 longitudinal striations. The above two species can be differentiated by the fact that the spicules measure 280–320 μ in the first and 220–230 μ in the second; the female tail has a rather blunt point with 3-5 annular striations near the tip in the first, and is acute and smooth in the second.

Genus *Ornithostrongylus* Trav., 1914.

O. quadriradiatus (Stev., 1904).—Found in small intestine of pigeon by Le Roux (1926) in Natal.

Genus *Libyostrongylus* Lane, 1923.

L. douglassii (Cobbold, 1882).—Frequent in the stomach of the ostrich.

Fam. *Syngamidae* Leiper, 1912.
Genus *Syngamus* Sieb., 1836.

S. trachea Montagu, 1811 (Syn. *S. trachealis* Sieb., 1836).—Occurs in certain districts, e.g. Western Province (Cape), in the trachea of fowls and turkeys. One always finds a male and a female in copula.

Digitised by the University of Pretoria, Library Services

Fam. *Protostrongylidae* Leiper, 1926 (Syn. *Metastrongylidae* Leiper, 1908).
Subfam. *Protostrongylinae* Kamensky, 1905 (Syn. *Metastrongylinae* Leiper, 1908).
Genus *Metastrongylus* Mol., 1861.

M. elongatus (Duj., 1845).—Found in the bronchioles of the pig, especially in the Western Cape Province.

Genus *Dictyocaulus* Rail. and Henry, 1907.

D. filaria (Rud., 1809).—Fairly frequent in certain parts in the bronchioles of sheep.

D. arnfieldi (Cobbold, 1884).—Found in the bronchioles of the horse as recorded by G. Theiler (1923), and by Veglia (1919) in the zebra.

Superfam. *Oxyuroidea* Rail., 1916.
Fam. *Oxyuridae* Cobbold, 1864.
Subfam. *Oxyurinae* Hall, 1916.
Genus *Oxyuris* Rud., 1803.

O. equi Schrank, 1788 (Syn. *O. curvula* Rud., 1803).—Horse, mule, donkey, zebra, mountain zebra, and rhinoceros (*Rhinaster bicornis*).

Subfam. *Oxysomatiinae* Rail., 1916.
Genus *Probstmayria* Rans., 1907.

P. vivipara (Probstmayr, 1865).—Horse, donkey, and zebra. (*Hippotigris burchelli wahlbergi*).

Fam. *Heterakidae* Rail. and Henry, 1914.
Subfam. *Heterakinae* Rail and Henry, 1912.
Genus *Heterakis* Duj., 1845.

H. gallinae (Gmel., 1790) (Syn. *H. vesicularis* Frölich, 1791, *H. papillosa* Rail., 1885).—Very frequent in caeca of fowl; also found in turkey, guinea-fowl (*Numida papillosa*), red-necked pheasant (*Pternistes swainsoni*), and the variegated sandgrouse (*Calopterocles burchelli*). These worms are 7-15 mm. long, the oesophagus is provided with a bulb, the male tail bears a circular preanal sucker, and twelve pairs of papillae (Fig. 26). There are two very unequal spicules.

Fam. *Subuluridae* Yorke and Maplestone, 1926.
Subfam. *Subulurinae* Trav., 1914.
Genus *Subulura* Molin, 1860.

S. suctoria (Mol., 1860).—Fairly frequent in caeca of fowl, occurring along with *Heterakis gallinae*, from which it can be distinguished by its slightly larger size, the oblong-shaped preanal sucker, and different papillae on the male tail (Fig. 27), while the spicules are equal and the oesphagus has an additional swelling in front of the bulb. This species has also been found in the Transvaal guinea-fowl, the red-necked pheasant, the harlequin quail (*Coturnix delagorguei*), the Zululand bush partridge (*Dendroperdix sephaena zuluensis*), the water thick-knee (*Oedicnemus vermiculatus*), and the Cape thick-knee (*Burhinops capensis capensis*).

Digitised by the University of Pretoria, Library Services

Fam. *Atractidae* Trav., 1919.
Subfam. *Crossocephalinae* Yorke and Maplestone, 1916.
Genus *Crossocephalus* Rail., 1909.

C. viviparus (Linst., 1899).—Large intestine of zebra.

Superfam. *Ascaroidea* Rail. and Henry, 1915.
Fam. *Ascaridae* Baird, 1853.
Subfam. *Ascarinae* Trav., 1913.
Genus *Ascaris* L., 1758.

A. suum. Goeze, 1782.—Frequent in small intestine of pig.

A. vitulorum Goeze, 1782.—Moderately frequent in small intestine of calves. This worm can be recognized by its fairly large size and the presence of a small acute point on the tail.

Genus *Toxocara* Stiles, (1905) (Syn. *Belascaris* Leiper, 1907).

T. canis (Werner, 1782) (Syn. *B. marginata* Rud., 1802).—Small intestine of dog; relatively rare. Large worms. The body is anteriorly bent ventrad, testis in anterior half of body, tail of male conical with a vermiform protuberance behind the anus, vulva in anterior part of body; eggs corrugated.

Genus *Toxascaris* Leiper, 1907.

T. leonina (Linstow, 1902) (Syn. *T. limbata* Rail. and Henry, 1911).—Small intestine of dog; frequent; also recorded by Veglia (1919) from the wild dog (*Lycaon pictus*). Not quite as large as the previous species; body anteriorly bent dorsad, testis in anterior part of posterior half of body, tail of male tapers to a point, vulva about middle of body, eggs oval and smooth.

Genus *Parascaris* Yorke and Maplestone, 1926.

P. equorum (Goeze, 1782) (Syn. *Ascaris megalocephala* Cloquet, 1824).—Frequent in small intestine of horse, mule, donkey, zebra (*Hippotigris burchelli wahlbergi*), and mountain zebra (*Hippotigris zebra*).

Subfam. *Ascaridiinae* Trav., 1919.
Genus *Ascaridia* Duj., 1845.

A. columbae (Gmel., 1790).—Small intestine of pigeon; fairly common.

A. lineata (Schneid., 1866).—Small intestine of fowl and turkey; frequent. All the material I have so far examined belongs to this species and not to *A. galli* (Syn. *A. perspicillum*), which is commonly named in text-books. Schwarz (1925), in a recent publication, announces that he has found the same state of affairs in the United States, and Le Roux (1926) also finds only *A. lineata* in fowls in Natal.

A. numidae (Leiper, 1908).—Small intestine of guinea-fowl (*Numida papillosa*) and the Transvaal guinea-fowl (*N. papillosa transvaalensis*).

These Ascaridias are fairly large worms with three lips, the oesophagus has no bulb, the male tail bears a circular preanal sucker, and in *A. columbae* fifteen pairs of papillae (Fig. 28), in *A. lineata* ten pairs (Fig. 29), in *A. perspicillum* nine pairs (Fig. 30), and in *A. numidae* ten pairs (Fig. 31).

Digitised by the University of Pretoria, Library Services

Superfam. *Spiruroidea* Rail. and Henry, 1915.
Fam. *Spiruridae* Oerley, 1855.
Subfam. *Spirurinae* Rail., 1915.

Genus *Spirocerca* Rail. and Henry, 1911.

S. sanguinolenta (Rud., 1819).—Found free in the pharynx and oesophagus of a dog; rare. Usual location is in nodules or tumours of the wall of oesophagus or stomach. These worms are large—3–8 cm. long, thick, frequently coiled in a spiral, and of a blood-red colour. They have two lips, the vulva is placed 2–3 mm. from the anterior end, the tail of the male is alate, and bears four pairs of preanal and two pairs postanal stalked papillae.

Genus *Habronema* Dies., 1861.

H. megastoma (Rud., 1819) (Syn. *Spiroptera megastoma*).—Frequent in the stomach of horse and zebra.

H. microstoma (Schneid., 1866) (Syn. *Spiroptera microstoma*).—Infrequent in stomach of horse and zebra.

H. muscae (Carter, 1861) (Syn. *Spiroptera muscae*).—Found in stomach of horse and zebra, and is the most frequent of the three species; practically every horse in South Africa harbours at least a few specimens; frequently the infection is heavy.

H. zebrae G. Theiler, 1923.—Found in the stomach of the zebra.

Genus *Hartertia* Seur., 1914.

H. gallinarum (Theiler, 1919) Cram. 1927. (Syn. *Filaria gallinarum* Theiler, 1919).—Small intestine of fowl; so far found only in South Africa. It has macroscopically very much the appearance of *Ascaridia lineata* of the fowl, but can be distinguished by the presence of two lips and the appearance of the male tail, which has no sucker and bears a sessile, unpaired and four pairs of stalked preanal papillae and two pairs of stalked postanal papillae (Fig. 37).

Subfam. *Arduenniae* Rail. and Henry, 1911.
Genus *Arduenna* Rail. and Henry, 1911.

A. strongylina (Rud., 1819).—Fairly frequent in the stomach of the pig. This species is 1–2 cm. long, filiform, and characterized by a multiple spiral of chitinous ridges strengthening the pharynx, which is 83–98 μ long (Fig. 32).

Genus *Physocephalus* Dies., 1861.

P. sexalatus (Mol., 1860).—Stomach of pig; less frequent than the previous species, from which it can be distinguished by its longer pharynx (over 200 μ), which is strengthened by a single spiral of chitinous rings and the presence of three lateral cuticular alae on each side of the anterior third of the body, beginning at about the same level as the oesophagus (Fig 33).

Subfam. *Gongyloneminae* Hall, 1916.
Genus *Gongylonema* Mol., 1857.

G. pulchrum (Mol., 1857) (Syn. *G. scutatum* Müller, 1869).—Frequent in the oesophagus of sheep, goats, and cattle, where the worm lies in a zig-zag fashion in the mucosa. In a recent paper, Baylis (1925A) shows that the *G. scutatum* of sheep and cattle is identical with the more previously described *G. pulchrum*, and in a

Digitised by the University of Pretoria, Library Services

subsequent paper Baylis (1925B) reports on his study of the human *G. subtile* Alessandrini, which he also finds to be identical with *G. pulchrum*. According to this author, therefore, man is liable to get infected with *G. pulchrum* from domestic animals through the agency of various insects—cockroaches and coprophagus beetles—which are the intermediate hosts of this parasite.

G. verrucosum (Giles, 1892).—Fairly frequent in the rumen of cattle.

G. mönnigi (Baylis, 1926).—Fairly frequent in the rumen of sheep and goats.

The Gongylonemas are long, thin worms, characterized by the presence of cuticular bosses on the anterior end of the body (Fig. 34). In *G. pulchrum* the tail of the female is straight; in the other two species it is curved in the form of a hook (Fig. 35). In *G. verrucosum* the left lateral cervical ala is notched; in *G. mönnigi* it has a straight border.

G. ingluvicola Rans., 1904.—Found infrequently in the crop of the fowl.

Fam. *Thelaziidae* Rail., 1916.
Genus *Thelazia* Bosc., 1819.

T. rhodesii (Desm. 1827).—Found not infrequently in certain parts in the conjunctival sac of the eye of cattle.

Fam. *Acuariidae* Seur., 1913.
Subfam. *Acuariinae* Rail., Henry, and Sis., 1912.
Genus *Acuaria* Brems., 1811.
Subgenus *Cheilospirura* (Dies., 1861).

A. (*Cheilospirura*) *hamulosa* (Dies., 1851).—Found in the posterior pouch of the gizzard of the fowl by Le Roux (1926) in Natal.

Subgenus *Dispharynx* R., H., and S., 1912.

A. (*Dispharynx*) *spiralis* (Mol., 1858).—Found once in the proventriculus of a fowl at Ceres, Cape Province.

The Acuarias are characterized by the presence of cuticular ridges on the anterior part of the body. In *Cheilospirura* these ridges run backwards only, without anastomosing, and the male has two very unequal spicules. In *Dispharynx* the ridges run backwards and also return forwards again without anastomosing (Fig. 36); the male spicules are unequal.

Fam. *Tetrameridae* Trav., 1914.
Subfam. *Tetramerinae* Rail., 1915.
Genus *Tetrameres* Crepl., 1846) (Syn. *Tropidocerca* Dies., 1851).

T. fissispina (Dies., 1861).—Fairly frequent in the proventriculus of the fowl, turkey, and guinea-fowl. The males are rarely found in the lumen of the proventriculus; the females, after having been fertilized, penetrate into the wall of the proventriculus, where their bodies swell up, becoming almost spherical and blood-red in colour; they have a diameter of about 2 mm.

Digitised by the University of Pretoria, Library Services

Superfam. *Filarioidea* Weinl., 1858.
Fam. *Filariidae* Claus., 1885.
Subfam. *Filariinae* Stiles, 1907.
Genus *Filaria* Müller, 1787.

(?) *F. spicularia* Neum., 1909.—Found under the peritoneum of the ostrich. This worm is known as the "ostrich guinea-worm," and reaches a length of over 200 cm. The morphology of this worm is at present being studied; it probably belongs to the genus *Contortospiculum*.

Genus *Cordophilus* Mönnig, 1926.

C. sagitta (Linstow, 1907).—Found in a myocardial tumour of an ox (Portuguese East Africa); free in the heart of a koodoo (*Strepsiceros strepsiceros*) (Transvaal); in a thrombus in the left ventricle of a bushbuck (*Tragelaphus sylvaticus*) (Kenya); and again free in the left ventricle of a bushbuck (Tanganyika Territory). These are white, fairly thick worms, tapering slightly at the posterior extremity, especially in the male, and very much anteriorily. The cuticle is not striated. The mouth opening is a circular pore and the head is nude, except for a few papillae which are, however, very indistinct. The oesophagus is fairly long and consists of an anterior muscular and a posterior glandular portion.

Male, 57 mm. long, 0·73 mm. thick. The tail (Fig. 38) is narrow and spirally coiled; it is not provided with alae and ends bluntly. There are two pairs of preanal papillae and a very large unpaired one, which is situated a short distance in front of the anus. The postanal paillae are four pairs situated closely behind the anus; the most anterior pair is placed just behind the lateral angles of the anal opening; a short distance behind these and slightly more median is a large pair of papillae, and between the latter, almost on the posterior lip of the anus, runs a row of four small papillae—two on each side. There are two unequal spicules; the left is 0·5 mm. long and its posterior part is almost wholly membranous; the right is 0·2 mm. long, it is more slender and is bent at about its middle (Fig. 39).

Female up to 75 mm. long and 1·2 mm. thick (Fig. 40). The head is 47 μ broad; the muscular oesophagus is 0·4 mm. long and the glandular portion 2·5 mm. The intestine is a very narrow tube. The nerve-ring is situated around the middle of the muscular part of the oesophagus. The vulva opens 2·1 mm. from the anterior end and leads into a short vagina, which is provided with a strong S-shaped sphincter as found, e.g. in *Habronema*. This is followed by a long ovijector, measuring 10·6 mm., which is at first narrow and finally widens out to form a reservoir joining two backwardly directed uteri. The latter make numerous windings forwards and backwards in the body, filling the body cavity, together with the ovaries from near the vagina to the tail. The latter is thick and blunt and bears the anus, which is a minute pore, very near to its end. The eggs measure 36 μ × 18 μ. Viviparous; the larvae, which did not appear to be very well fixed, measure 0·33 mm. in length.

Yorke and Maplestone (1926) place this species in the genus *Wuchereria* Silva Araujo, 1877, but according to the generic diagnosis given by these authors it does not belong there, differing from this diagnosis in the following points: not delicate, head not enlarged, caudal alae not present, long spicule does not end in a spoon-like

Digitised by the University of Pretoria, Library Services

termination, short spicule not coarsely marked distally, gubernaculum absent, tail of female very short, microfilariae not sheathed (according to Turner).

Subfam. *Onchocercinae* Leiper, 1911.
Genus *Onchocerca* Dies., 1841.

O. gibsoni Cleland and Johnston, 1910.—Cattle; not very frequent. These are long, thin worms, forming nodules, in which they lie coiled up, in the intramuscular connective tissue; they can frequently be felt through the skin, especially in the region of the brisket.

Subfam. *Setariinae* Yorke and Maplestone, 1926.
Genus *Setaria* Viborg, 1795.

S. equina (Abildg., 1789).—Fairly frequent in the peritoneal cavity of the horse; also found in the zebra.

S. labiato-papillosa (Aless., 1838).—Found infrequently in the peritoneal cavity of cattle. The Setarias are fairly large worms, about 10 cm. long; the tail of the male is twisted in the form of a spiral, and in both sexes there are a pair of lateral appendages to the tail. The mouth is surrounded by a chitinous ring, which is indented in such a way that there appear to be two dorsal and two ventral chitinous papillae.

(?) *S. bernardi* Rail. and Henry, 1911.—Peritoneal cavity of the pig; rare. All the available descriptions of this worm are rather short, and, since the original also lacks illustrations, I am not able to identify the specimens at hand with *S. bernardi*, since they seem to differ from the descriptions of that species and also from the drawings given by Smit (1920). The specimens in question are six females and one male, collected from the peritoneal cavity of a pig in Portuguese East Africa by Dr. A. Ayres. I shall give a short description of them here, and add in brackets corresponding data from the original description of *S. bernardi* for comparison.

The largest female measures 13·8 cm. in length (20–21 cm. for *S. bernardi*, which is specially notable for its large size) by 760 μ in breadth at the middle of the body (608–840 μ), and 141 μ broad at the level of the anus (148 μ). The chief characteristic of these worms is a very conspicuous shoulder-like prominence on each side of the head, each prominence bearing three papillae, of which one is lateral and the other two placed slightly more backwards and medially (Fig. 41; only two of the three papillae show on each side). Nothing of this sort is mentioned in the descriptions of *S. bernardi*, although Smit draws the head with a somewhat similar prominence all around. The peribuccal ring, which is said to be large in *S. bernardi* (87-88 μ), measures 75 μ in a dorso-ventral direction, and shows the usual two dorsal and two ventral chitinous "papillae." The tail is 404 μ long (300 μ), bears two lateral appendages, and has a tuberculated end. The oesophagus has a muscular portion 960 μ long and thicker, opaque, glandular portion 7·7 mm. long; in *S. bernardi* the oesophagus is said to be 750–800 μ long, but it is evident that only the muscular portion was measured.

The male is 8 cm. long (10–11 cm.) and 550 μ thick (650 μ). The hind end is twisted in the form of a spiral, the tail is 160 μ long (192 μ). There are four pairs of preanal papillae and nine postanals,

Digitised by the University of Pretoria, Library Services

which are all placed rather irregularly in this specimen (Fig. 42). The preanals are situated at the following distances from the tip of the tail:—No. 1, 168 μ (300 μ), i.e. 8 μ (108 μ) in front of the anus; No. 2, 219 μ and 280 μ (360 μ); No. 3, 235 μ and 275 μ (450 μ); No. 4, 290 μ and 342 μ (520 μ). There are two unequal spicules, the right is thick and 137 μ long (140 μ), the left has a proximal solid portion 212 μ long (215 μ), and a distal membranous portion 141 μ long (70 μ).

LIST OF HOSTS WITH PARASITES RECORDED.

The names of authors in brackets indicate that the corresponding parasites were recorded by them, and not found by myself:—

Ostrich (*Struthio australis*).

Houttuynia struthionis.
? *Filaria spicularia.*
Codiostomum struthionis.
Libyostrongylus douglassii.

Fowl (*Gallus gallus*).

Davainea proglottina.
Raillietina (*Ransomia*) *echinobothrida.*
Raillietina (*Ransomia*) *tetragona.*
Raillietina (*Skriabinia*) *cesticillus.*
Amoebotaenia sphenoides.
Choanotaenia infundibuliformis.
Hymenolepis carioca.
Hymenolepis inermis (Le Roux).
Hymenolepis sp. (Le Roux).
Capillaria retusa (Le Roux.)
Capillaria strumosa (Le Roux).
Ascaridia lineata.
Heterakis gallinae.
Subulura suctoria.
Gongylonema ingluvicola.
Tetrameres fissispina.
Acuaria (*Cheilospirura*) *hamulosa* (Le Roux).
Acuaria (*Dispharynx*) *spiralis.*
Hartertia gallinarum.
Syngamus trachea.
Trichostrongylus tenuis (Le Roux).

Turkey (*Meleagris gallopavo domesticus*).

Ascaridia lineata.
Heterakis gallinae.
Tetrameres fissispina.
Syngamus trachea.

Guinea Fowl (*Numida meleagris*).

Ascaridia numidae.
Heterakis gallinae.
Tetrameres fissispina.

Transvaal Guinea Fowl (*Numida papillosa transvaalensis*).

Ascaridia numidae.
Subulura suctoria.

Domestic Pigeon (*Columba livia domestica*).

Raillietina (*Raillietina*) *crassula* (Le Roux).
Capillaria columbae (Le Roux).
Ascaridia columbae.
Orinthostrongylus quadriradiatus (Le Roux)

Rednecked Pheasant (*Pternistes swainsoni*).

Heterakis gallinae.
Subulura suctoria.

Variegated Sandgrouse (*Calopterocles burchelli*).

Heterakis gallinae.

Harlequin Quil (*Coturinx delagorguei*).

Zululand Bush Partridge (*Dendroperdix sephaena zuluensis*).

Water Thicknee (*Oedicnemus vermiculatus*).

Cape Thicknee (*Burhinops capensis capensis*).

Subulura suctoria.

Digitised by the University of Pretoria, Library Services

Sheep (*Ovis aries*).

Paramphistomum calicophorum.
Paramphistomum microbothrium.
Paramphistomum sp.
Fasciola hepatica.
Fasciola gigantica.
Moniezia expansa.
Moniezia trigonophora.
Thysanosoma giardi.
Avitellina centripunctata.
Stilesia hepatica.
Echinococcus granulosus (cyst).
Cysticercus tenuicollis.
Multiceps multiceps.
Strongyloides papillosus.
Trichocephalus ovis.
Gongylonema pulchrum.
Gongylonema mönnigi.
Bunostomum trigonocephalum.
Gaigeria pachyscelis.
Oesophagostomum columbianum.
Trichostrongylus instabilis.
Trichostrongylus axei.
Trichostrongylus rugatus.
Cooperia oncophora (Veglia).
Haemonchus contortus.
Nematodirus spathiger.
Ostertagia circumcincta.
Ostertagia ostertagi.
Chabertia ovina (Veglia).
Dictyocaulus filaria.

Goat (*Capra hircus*).

Moniezia trigonophora.
Thysanosoma giardi.
Stilesia hepatica.
Echinococcus granulosus (cyst.).
Cysticercus tenuicollis.
Multiceps gaigeri.
Strongyloides papillosus.
Trichocephalus ovis.
Gongylonema pulchrum.
Gongylonema mönnigi.
Bunostomum trigonocephalum.
Oesophagostomum columbianum.
Trichostrongylus instabilis.
Trichostrongylus axei.
Trichostrongylus rugatus.
Haemonchus contortus.
Nematodirus spathiger.
Ostertagia circumcincta.
Ostertagia ostertagi.

Cattle (*Bos taurus*).

Paramphistomum calicophorum.
Paramphistomum microbothrium.
Paramphistomum sp.
Fasciola hepatica.
Fasciola gigantica.
Schistosoma bovis.
Moniezia alba.
Moniezia expansa.
Moniezia trigonophora.
Thysanosoma giardi.
Stilesia hepatica.
Cysticercus bovis.
Echinococcus granulosus (cyst.).
Trichocephalus ovis.
Ascaris vitulorum.
Gongylonema pulchrum.
Gongylonema verrucosum.
Thelazia rhodesi.
Setaria labiato-papillosa.
Cordophilus sagitta.
Onchocerca gibsoni.
Bunostomum phlebotomum.
Oesophagostomum radiatum.
Trichostrongylus instabilis.
Cooperia pectinata.
Cooperia punctata.
Haemonchus contortus.

Common Duiker (*Sylvicapra grimmi transvaalensis*)

Moniezia trigonophora (Baer).
Avitellina centripunctata (Baer).
Stilesia hepatica (Wolffhügel).
Cysticercus tenuicollis (Gough).

Blue Duiker (*Cephalophus monticola*).

Moniezia expansa (Gough).

Common Steenbok (*Pediotragus horstocki*).

Sharp's Steenbok (*Pediotragus sharpei*).

Moniezia trigonophora (Baer).
Avitellina centripunctata (Baer).

Hartebeest (*Bubalis caama*).

Thysanosoma giardi.

Klipspringer (*Oreotragus oreotragus*).

Avitellina centripunctata (Baer).

Roan Antelope (*Hippotragus equinus*).

Avitellina centripunctata (Baer).
Stilesia hepatica (Wolffhügel).

Digitised by the University of Pretoria, Library Services

WATERBUCK (*Kobus ellipsiprymnus ellipsiprymnus*).

Stilesia hepatica.

GEMSBOK (*Oryx gazella*).

Cysticercus tenuicollis.

BUSHBUCK (*Tragelaphus sylvaticus*).

Cordophilus sagitta.

Oesophagostomum columbianum.

KOODOO (*Strepsiceros strepsiceros*).

Cordophilus sagitta.

SPRINGBOK (*Antidorcas marsupialis*).

MOUNTAIN REEDBUCK (*Redunca fulvorufula*).

Cysticercus tenuicollis (Gough, latter case).

COMMON REEDBUCK (*Redunca arundinum*).

Bunostomum trigonocephalum.

Cysticercus tenuicollis (Gough).

ELAND (*Taurotragus oryx*).

Thysanosoma giardia (Gough).

CAMEL (*Camelus dromedarius*).

Moniezia planissima.

HORSE (*Equus caballus*).

Gastrodiscus aegyptiacus.
Anoplocephala magna.
Anoplocephala perfoliata.
Anoplocephala mammilana (Veglia).
Moniezia pallida.
Probstmayria vivipara.
Parascaris equorum.
Oxyuris equi.
Habronema megastoma.
Habronema microstoma.
Habronema muscae.
Setaria equina.
Strongylus (*Strongylus*) *equinus.*
Strongylus (*Alfortia*) *edentatus.*
Strongylus (*Delafondia*) *vulgaris.*
Trichonema (*Cylicostomum*) *labratum.*
Trichonema (*Cylicostomum*) *labiatum.*
Trichonema (*Cylicostomum*) *labiatum var. digitatum.*
Trichonema (*Cylicostomum*) *coronatum.*
Trichonema (*Cylicocercus*) *alveatum.*
Trichonema (*Cylicocercus*) *catinatum.*
Trichonema (*Cylicocercus*) *catinatum var. pseudocatinatum.*
Trichonema (*Cylicocercus*) *pateratum.*
Trichonema (*Cylicocercus*) *goldi.*
Trichonema (*Cylicocyclus*) *insigne.*
Trichonema (*Cylicocyclus*) *radiatum.*
Trichonema (*Cylicocyclus*) *elongatum.*
Trichonema (*Cylicocyclus*) *elongatum var. Kotlani.*
Trichonema (*Cylicocyclus*) *nassatum.*
Trichonema (*Cylicocyclus*) *nassatum var. parvum.*
Trichonema (*Cylicocyclus*) *leptostomum.*
Trichonema (*Trichonema*) *calicatum.*
Trichonema (*Trichonema*) *minutum.*
Trichonema (*Trichonema*) *longibursatum.*
Trichonema (*Trichonema*) *poculatum.*
Trichonema (*Cylicotetrapedon*) *asymetricum* (G. Theiler).
Trichonema (*Cylicodontophorus*) *bicoronatum.*
Trichonema (*Cylicodontophorus*) *euproctum.*
Trichonema (*Cylicodontophorus*) *mettami.*
Trichonema (*Cylicodontophorus*) *ultrajectinum*
Trichonema (*Cylicobrachitus*) *brevicapsulatum.*
Trichonema (*Cylicotoichus*) *Montgomeryi.*
Poteriostomum imparidentatum.
Poteriostomum Ratzii.
Poteriostomum Ratzii var. nanum (G. Theiler).
Oesophagodontus robustus.
Gyalocephalus capitatus.
Triodontophorus serratus.
Triodontophorus brevicauda.
Triodontophorus tenuicollis.
Triodontophorus minor.
Craterostomum mucronatum.
Trichostrongylus axei.
Dictyocaulus arnfieldi.

MULE (*Equus caballus* × *E. asinus*).

Parascaris equorum.
Oxyuris equi.
Strongylus (*Strongylus*) *equinus.*
Strongylus (*Alfortia*) *edentatus.*
Strongylus (*Delafondia*) *vulgaris.*
Trichonema (*Cylicocyclus*) *leptostomum.*
Trichonema (*Trichonema*) *calicatum.*
Trichonema (*Trichonema*) *minutum.*
Trichonema (*Trichonema*) *longibursttum.*
Trichonema (*Cylicotetrapedon*) *asymetricum* (G. Theiler).

Digitised by the University of Pretoria, Library Services

Trichonema (*Cylicostomum*) *labratum*.
Trichonema (*Cylicostomum*) *labiatum*.
Trichonema (*Cylicostomum*) *labiatum var. digitatum*.
Trichonema (*Cylicostomum*) *coronatum*.
Trichonema (*Cylicocercus*) *catinatum*.
Trichonema (*Cylicocercus*) *catinatum var. pseudocatinatum*.
Trichonema (*Cylicocercus*) *pateratum*.
Trichonema (*Cylicocercus*) *goldi*.
Trichonema (*Cylicocyclus*) *insigne*.
Trichonema (*Cylicocyclus*) *radiatum*.
Trichonema (*Cylicocyclus*) *adersi*.
Trichonema (*Cylicocyclus*) *nassatum*.
Trichonema (*Cylicocyclus*) *nassatum var. parvum*.
Trichonema (*Cylicodontophorus*) *bicoranatum*
Trichonema (*Cylicodontophorus*) *euproctum*.
Trichonema (*Cylicodontophorus*) *mettami*.
Trichonema (*Cylicodontophorus*) *ultrajectinum*.
Trichonema (*Cylocotoichus*) *montgomeryi*.
Poteriostomum imparidentatum.
Poteriostomum Ratzii.
Oesophagodontus robustus.
Gyalocephalus capitatus.
Triodontophorus serratus.
Triodontophorus tenuicollis.
Triodontophorus minor.
Craterostomum mucronatum.

Donkey (*Equus asinus*).

Anoplocephala magna.
Anoplocephala perfoliata.
Probstmayria vivipara.
Parascaris equorum.
Oxyuris equi.
Strongylus (*Strongylus*) *equinus*.
Strongylus (*Alfortia*) *edentatus*.
Strongylus (*Delafondia*) *vulgaris*.
Trichonema (*Cylicostomum*) *aegyptiacum*.
Trichonema (*Cylicostomum*) *labratum*.
Trichonema (*Cylicostomum*) *labiatum*.
Trichonema (*Cylicostomum*) *labiatum var. digitatum*.
Trichonema (*Cylicostomum*) *coronatum*.
Trichonema (*Cylicocercus*) *catinatum*.
Trichonema (*Cylicocercus*) *catinatum var. pseudocatinatum*.
Trichonema (*Cylicocercus*) *pateratum*.
Trichonema (*Cylicocercus*) *goldi*.
Trichonema (*Cylicocyclus*) *insigne*.
Trichonema (*Cylicocyclus*) *radiatum*.
Trichonema (*Cylicocyclus*) *triramosum*.
Trichonema (*Cylicocyclus*) *elongatum*.
Trichonema (*Cylicocyclus*) *elongatum var. Kotlani*.
Trichonema (*Cylicocyclus*) *adersi*.
Trichonema (*Cylicocyclus*) *auriculatum*.
Trichonema (*Cylicocyclus*) *nassatum*.
Trichonema (*Cylicocyclus*) *nassatum var. parvum*.
Trichonema (*Cylicocyclus*) *leptostomum*.
Trichonema (*Trichonema*) *calicatum*.
Trichonema (*Trichonema*) *minutum*.
Trichonema (*Trichonema*) *longibursatum*.
Trichonema (*Cylicotetrapedon*) *asymetricum* (G. Theiler).
Trichonema (*Cylicodontophorus*) *bicoronatum*.
Trichonema (*Cylicodontophorus*) *euproctum*.
Trichonema (*Cylicodontophorus*) *mettami*.
Poteriostomum imparidentatum.
Poteriostomum Ratzii.
Gyalocephalus capitatus.
Triodontophorus serratus.
Triodontophorus brevicauda.
Triodontophorus tenuicollis.
Triodontophorus minor.
Craterostomum mucronatum.

Wahlberg's Zebra (*Hippotigris burchelli wahlbergi*).

Anoplocephala magna.
Anoplocephala perfoliata.
Probstmayria vivipara.
Parascaris equorum.
Oxyuris equi.
Crossocephalus viviparus.
Habronema megastoma.
Habronema microstoma.
Habronema muscae.
Habronema zebrae (G. Theiler).
Setaria equina.
Strongylus (*Delafondia*) *vulgaris*.
Trichonema (*Cylicostomum*) *coronatum*.
Trichonema (*Cylicostomum*) *aegyptiacum*.
Trichonema (*Cylicocercus*) *alveatum*.
Trichonema (*Cylicocyclus*) *ingigne*.
Trichonema (*Cylicocyclus*) *triramosum*.
Trichonema (*Cylicocyclus*) *adersi*.
Poteriostomum imparidentatum.
Poteriostomum Ratzii.
Craterostomum mucronatum.
Cylindropharynx intermedia.
Cylindropharynx ornata.
Dictyocaulus arnfieldi (Veglia).

Mountain Zebra (*Hippotigris zebra*).

Parascaris equorum.
Oxyuris equi.
Strongylus (*Delafondia*) *vulgaris*.
Strongylus (*Delafondia*) *asini*.
Trichonema (*Cylicostomum*) *aegyptiacum*.
Trichonema (*Cylicocyclus*) *insigne*.
Trichonema (*Cylicocyclus*) *triramosum*.
Trichonema (*Cylicocyclus*) *auriculatum*.
Trichonema (*Trichonema*) *calicatum*.
Trichonema (*Trichonema*) *minutum*.
Trichonema (*Trichonema*) *longibursatum*.
Triodontophorus serratus.
Triodontophorus tenuicollis.
Triodontophorus minor.
Craterostomum mucronatum.
Cylindropharynx intermedia.

Digitised by the University of Pretoria, Library Services

WHITE RHINOCEROS (*Ceratotherium simum*).

Anoplocephala magna.

BLACK RHINOCEROS (*Rhinaster bicornis*).

Oxyuris equi.

PIG (*Sus scrofa domestica*).

Cysticercus cellulosae.
Echinococcus granulosus (cyst.).
Cysticercus tenuicollis.
Trichocephalus suis.
Ascaris suum.
Stephanuris dentatus.
Arduenna strongylina.
Physocephalus sexalatus.
? Setaria bernardi.
Oesophagostomum dentatum.
Metastrongylus elongatus.

DOG (*Canis familiaris*).

Dipylidium caninum.
Dipylidium sexcoronatum.
Taenia hydatigena.
Taenia multiceps.
Taenia serrata.
Taenia ovis (Baer).
Echinococcus granulosus.
Toxocara canis.
Toxascaris leonina.
Spiroptera sanguinolenta.
Ancylostoma caninum.
Ancylostoma braziliense.

CAT (*Felis domestica*).

Paragonimus westermanii.
Dipylidium sexcoronatum.
Taenia taeniaeformis.
Echinococcus granulosus (Veglia).
Ancylostoma caninum.

SMALL SPOTTED GENET (*Genetta ludia*).

Ancylostoma caninum.

BLACK-BACKED JACKAL (*Thos mesomelas*).

Dipylidium caninum (Gough).
Taenia multiceps.

LONG-EARED FOX (*Otocyon megalotis*).

AARDWOLF (*Proteles cristatus*).

Dipylidium caninum (Baer).

WILD DOG (*Lycaon pictus*).

Echinococcus granulosus.
Toxascaris leonina (Veglia).

SILVER FOX (*Vulpes chama*).

Echinococcus granulosus.

LITERATURE CITED.

1925. Baer, J. G.: "Contributions to the Helminth fauna of South Africa." Government Prnting and Stationery Office, Pretoria, pp. 1-79, 43 figs.

1925*a*. Baylis, H. A.: "On Gongylonema collected in Italy during October, 1924, with some remarks on the Genus." *Jl. Trop. Med. Hyg.*, xxviii, Pt. 3, pp. 71-76.

1925*b*. Baylis, H. A.: "On the Identity of *Gongylonema subtile*, Aless. *Jl. Trop. Med. Hyg.*, xxviii, pp. 361-2.

1926. Baylis, H. A.: "On the male of *Gongylonema verrucosum* and on a new species of *Gongylonema* from the Sheep." *Jl. Comp. Path. Therap.* 39. (2). 134.

1911. Bernard, N., and Bauche, J.: Filaire peritoneale du porc." Bul. Soc. Path. Exot. IV, No. 7, pp. 482-5.

1926. Cameron, T. W. M.: "Observations on the Genus *Echinococcus*, Rud., 1801. *Jl. of Helminthology.* IV. (1). 23-26.

1924. Cram, E. B.: "A new Nematode, *Cylindropharynx ornata*, from the Zebra, with keys to related Nematode Parasites of the Equidae." Jl. Agric. Res. xxviii, No. 7, pp. 661-672.

Digitised by the University of Pretoria, Library Services

1915. Douthitt, H.: "Studies on the Cestode Family *Anoplocephalidae*." Ill. Biol. Monogr. I, No. 3, pp. 1-97, 6 pls.

1908. Gough, L. H.: "Notes on South African Parasites." Rep. S.A. Ass. for the Adv. of Sc., 6th Meeting, p. 167.

1922. Ihle, J. E. W.: "Report of the Commission appointed to inquire into the Sclerostomiasis in Holland." I. Zoological, part I, 118 pp. The Hague.

1927. Le Roux, P. L.: "Helminths collected from the Domestic Fowl and the Domestic Pigeon in Natal." 11th and 12th Reports of the D.V.E. and R., Pretoria.

1926. Monnig, H. O.: "Three New Helminths." Trans. Roy. Soc. S.A. XIII. (3), pp. 291-298.

1927. Monnig, H. O.: "Helminthological Notes." 11th and 12th Reports of the D.V.E. and R., Pretoria.

1924. Roberts, A.: "Synoptic check-list of the Birds of South Africa." Ann. Transvaal Mus. X., P. 3, pp. 89-195, 4 pls.

1925. Schwarz, B.: "*Ascaridia lineata*, a parasite of chickens in the U.S." *Jl. Agr. Res.* xxx, No. 8, pp. 763-772.

1918. Smit, H. J.: "Een drietal wormen van het varken." Ned. Ind. Bl. Diergen. D. 30, Afl. 6, pp. 592-600.

1920. Smit, H. J.: "Nog enkele aantekeningen over 'een drietal wormen van het varken'." Ned. Ind. Bl. Diergen. D. 32, Afl. 2 and 3, pp. 152-153.

1919. Veglia, F.: "Il vermi parasitti negli animali del Sud-Africa." Ann. Accad. Agric. Torino. LXII, pp. 1-24.

1926. Yorke, W., and Maplestone, P. A.: "The Nematode Parasites of Vertebrates." 536 p., London.

ADDENDUM.

Trichostrongylus falculatus Ransom, 1911. Sheep, small intestine.
Ostertagia trifurcata Ransom, 1907. Sheep, abomasum.

Digitised by the University of Pretoria, Library Services

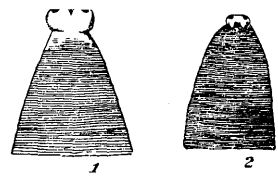


Fig.—1. *Anoplocephala magna*—anterior end.
Fig.—2. *Anoplocephala perfoliata*—anterior end.

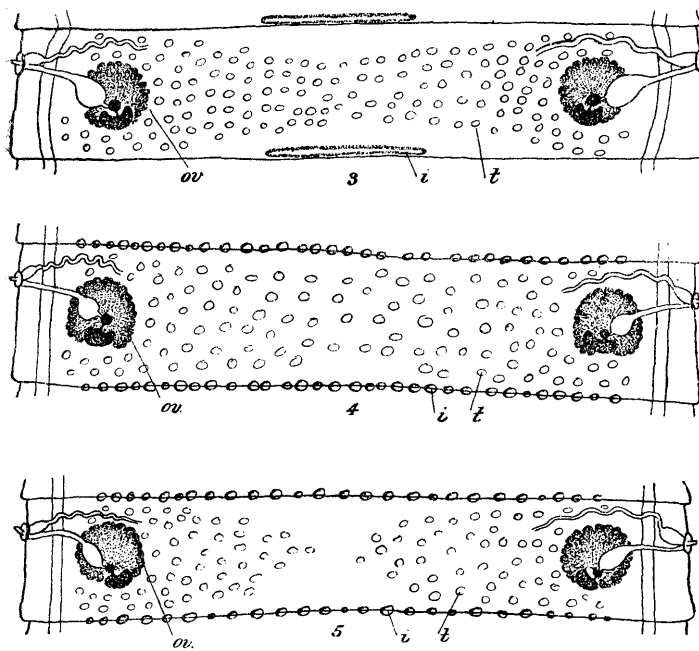
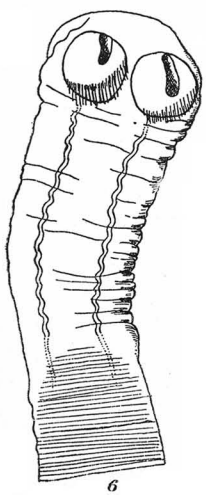
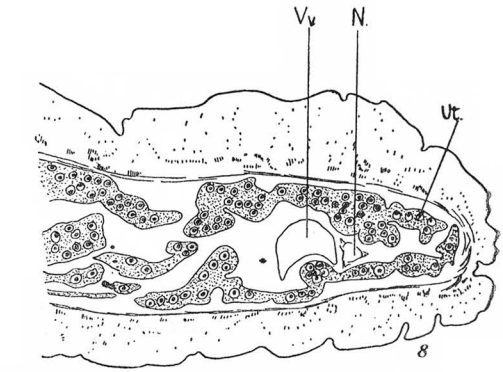


Fig. 3.—*Moniezia planissima*—mature segment i = interproglottidal glands, t = testes, ov = ovary.
Fig. 4.—*Moniezia expansa*—mature segment.
Fig. 5.—*Moniezia trigonophora*—mature segment.

Digitised by the University of Pretoria, Library Services



6



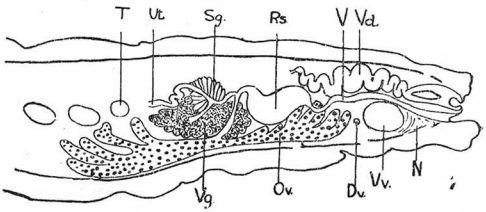
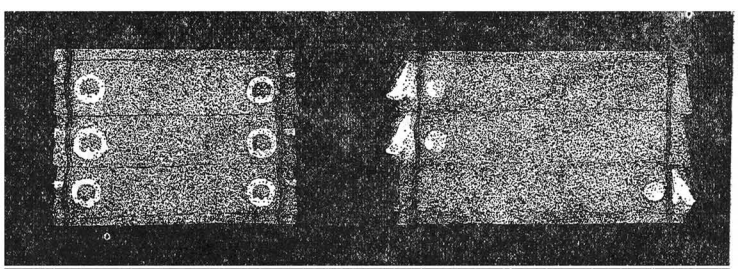


Fig. 6.—*Moniezia pallida* Head ventral view.

Fig. 7.— „ „ Compilation of several transverse sections through a mature proglottis to show the relations of the genital organs on the right side.

Fig. 8.— „ „ Transverse section of a ripe proglottis showing the uterine branches passing ventrally as well as dorsally to the longitudinal excretory vessels.
Dv. dorsal vessel, N. nerve, Ov. ovary, Rs. receptaculum seminis, Sg. Shellgland, T. testis, Ut. uterus, V. vagina, Vd. vas deferens, Vg. vitelline gland, Vv. ventral vessel.



9a 9b

10

Fig. 9.—(*a*) *Moniezia*, (*b*) *Thysanosoma giardi*, mature segments as seen on a dark background, 4×.

Fig. 10.—*Avitellina centripunctata*, ripe part of worm as seen on a dark background, 3×.

Digitised by the University of Pretoria, Library Services

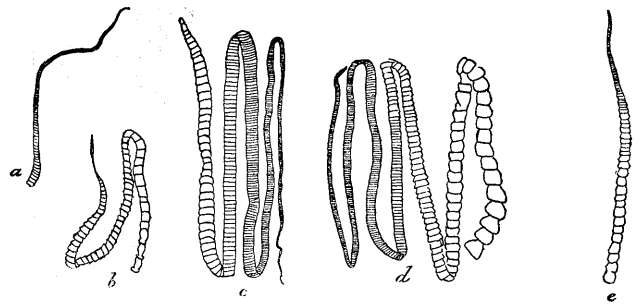


Fig. 11.—*a. Hymenolepis carioca, b. Choanotaenia infundibuliformis, c. Raillietina tetragona, d. Raillietina echinobothrida, e. Raillietina cesticillus.* Natural size. After Ransom (1905).

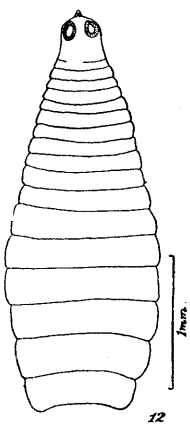


Fig. 12.—*Amoebotaenia sphenoides.*

Digitised by the University of Pretoria, Library Services

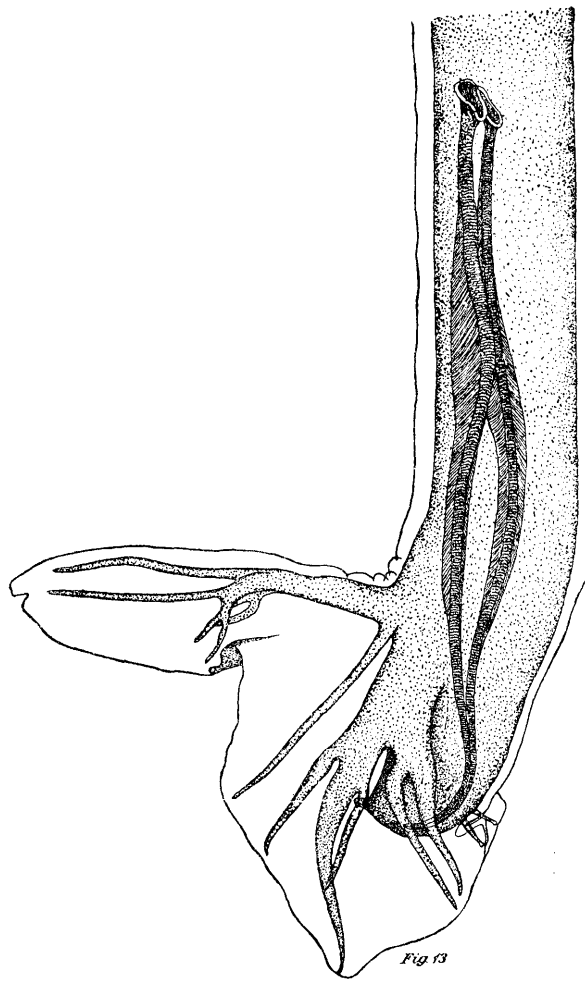
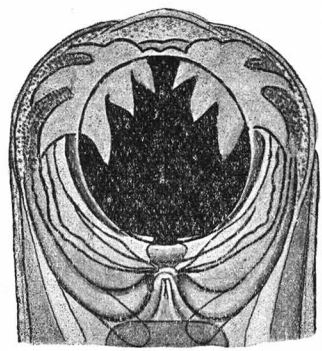


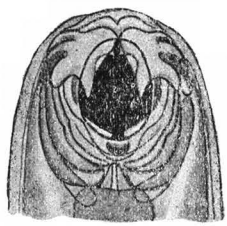
Fig. 13.—*Codiostomum struthionis*—male bursa, lateral view.

Fig. 14.—*Oesophagostomum columbianum*—male bursa (after Ransom)
Fig. 15.—*Oesophagostomum radiatum*—male bursa (after Ransom).

Digitised by the University of Pretoria, Library Services



16



17

FIG. 16.—*Ancylostoma caninum*—head (after Looss).
FIG. 17.—*Ancylostoma braziliense*—head (,, ,,)

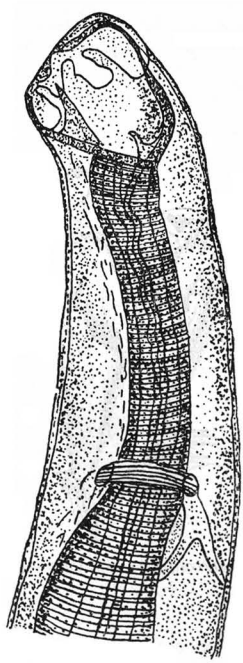


Fig. 18.—*Bunostomum trigonocephalum*—anterior end (after Ransom)

Digitised by the University of Pretoria, Library Services

Fig. 19.—*Trichostrongylus instabilis* — male spicules and gubernaculum (after Ransom)
Fig. 20.—*Trichostrongylus axei*—male spicules (after Ransom).

Fig. 21.—*Trichostrongylus rugatus*—male spicules.

Digitised by the University of Pretoria, Library Services

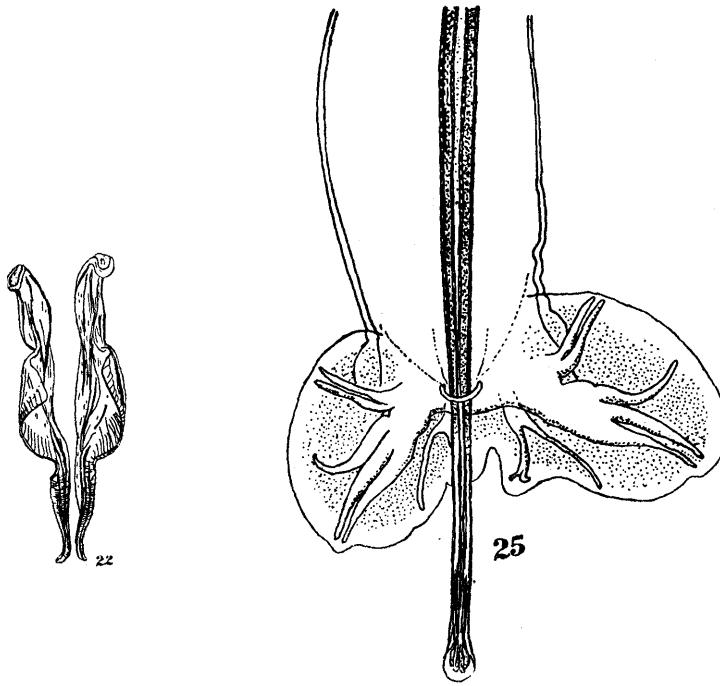


Fig. 22.—*Cooperia pectinata*—male spicules (after Ransom).
Fig. 25.—*Nematodirus spathiger*—male bursa (after Ransom)

Fig. 23.—*Cooperia punctata*—male spicules (after Ransom).

Digitised by the University of Pretoria, Library Services

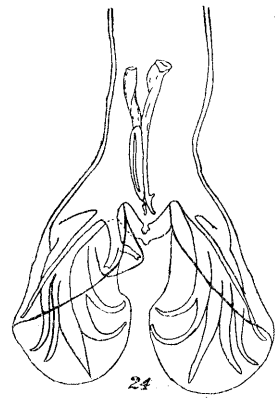
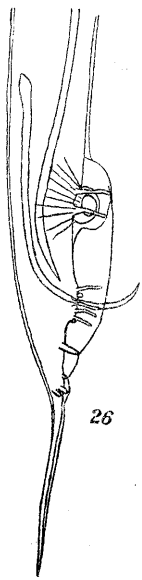


Fig. 24.—*Haemonchus contortus*—male bursa (after Ransom).



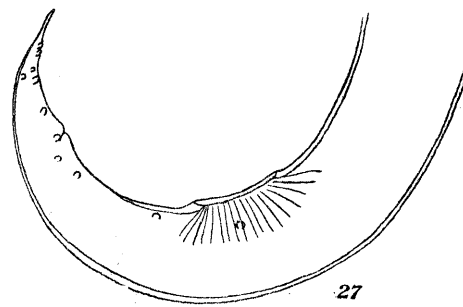


Fig. 26.—*Heterakis gallinae*—tail of male.
Fig. 27.—*Subulura suctoria*—tail of male.

Digitised by the University of Pretoria, Library Services

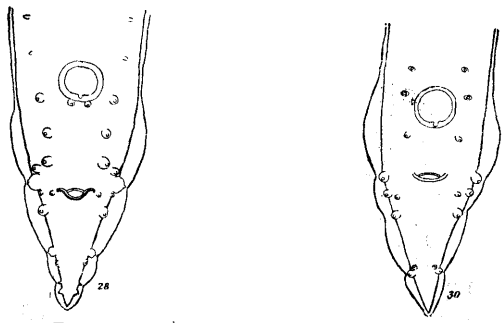


Fig. 28.—*Ascaridia columbae*—tail of male.
Fig. 30.—*Ascaridia perspicillum*—tail of male.

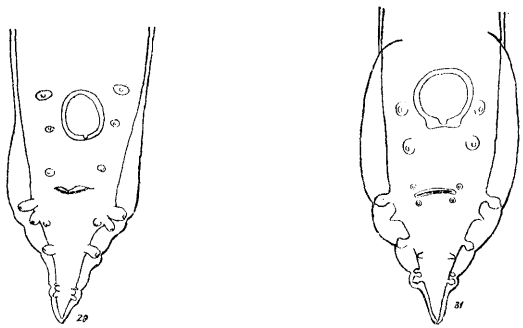


Fig. 29.—*Ascaridia lineata*—tail of male.
Fig. 31.—*Ascaridia numidae*—tail of male.

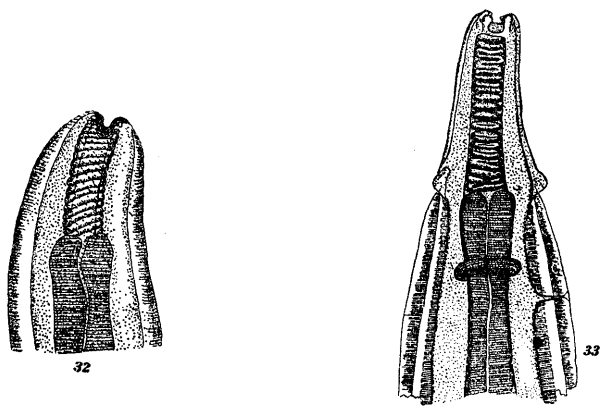
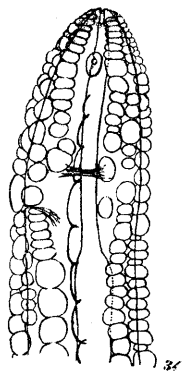


Fig. 32.—*Arduenna strongylina*—anterior end (after Foster).
Fig. 33.—*Physocephalus sexalatus*—anterior end (after Foster).

Digitised by the University of Pretoria, Library Services



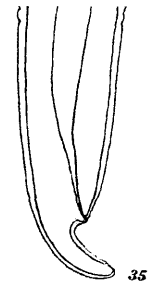


Fig. 34.—*Gongylonema verrucosum*—anterior end, lateral view.
Fig. 35.— „ „ tail of female.

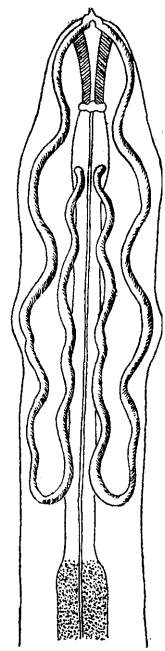


Fig. 36.—*Acuaria* (*Dispharynx*) *spiralis*—anterior end.

Digitised by the University of Pretoria, Library Services

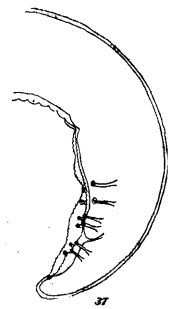


Fig. 37.—*Hartertia gallinarum*—tail of male. An unpaired precloacal papilla is left out in the figure.

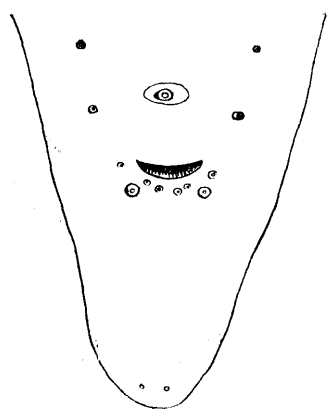


Fig. 38.—*Cordophilus sagitta*—tail end of male.

Digitised by the University of Pretoria, Library Services

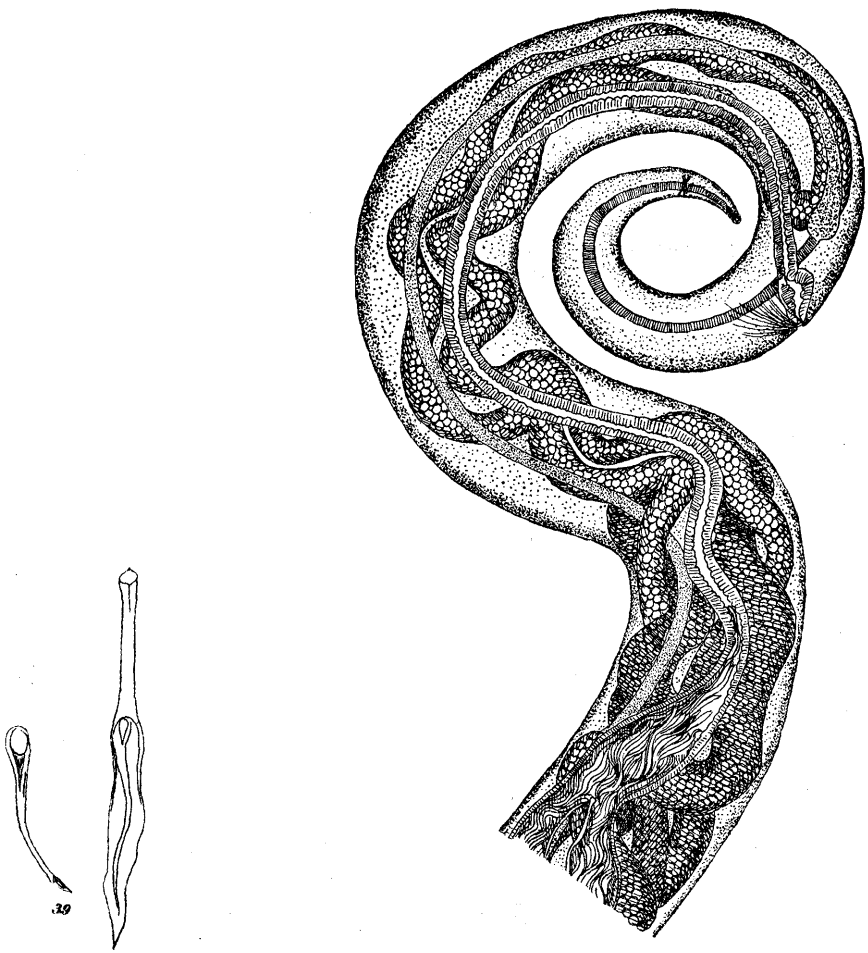
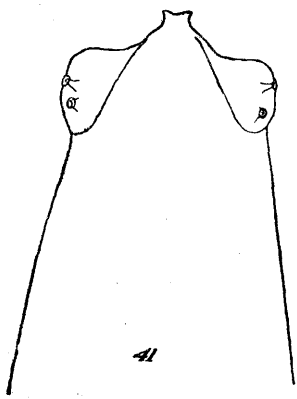


Fig. 39.—*Cordophilus sagitta*—male spicules.
Fig. 40.—*Cordophilus sagitta*—anterior end of female.

Digitised by the University of Pretoria, Library Services



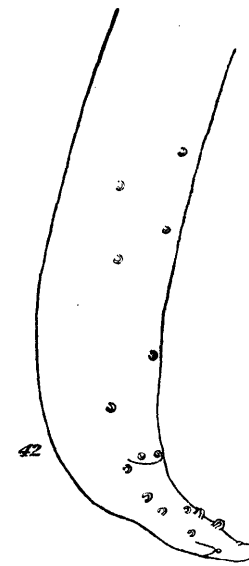


Fig. 41.—*Setaria* from Pig—head end.
Fig. 42.—*Setaria* from Pig—tail end of male.

Digitised by the University of Pretoria, Library Services